What is claimed is:

1. An organic circuit element comprising:

a) a plurality of members, each of which comprises an oligonucleotide duplex, said plurality of members comprising:

i) at least one donor member for receiving conduction electrons from an electron donor;

ii) at least one acceptor member for communicating with an electron acceptor to provide a region of attraction for said conduction electrons; and

iii) at least one regulator member intersecting with at least one of said plurality of members to define at least one electric field regulation junction, for cooperating with an electric field regulator to regulate an electric field at the junction;

wherein the electron donor or the electron acceptor are adapted to be reversibly chemically modified to alter the conductivity of the organic circuit element under conditions that preserve the conductivity of the circuit element.

2. The organic circuit element of claim **1** wherein at least some of said members comprise a conductive metal-containing oligonucleotide duplex.

3. The organic circuit element of claim **1** wherein each of said members comprises a conductive metal-containing oligonucleotide duplex.

4. The organic circuit element of claim 1 wherein each of said at least one donor member and said at least one acceptor member comprises a conductive metal-containing oligonucleotide duplex.

5. The organic circuit element of claim 2 further comprising said electron donor in electrical communication with said donor member.

6. The organic circuit element of claim 2 further comprising said electron acceptor in electrical communication with said acceptor member.

7. The organic circuit element of claim 2 further comprising said electric field regulator in electrical communication with said regulator member.

8. The organic circuit element of claim 7 further comprising said electron donor in electrical communication with said donor member, and further comprising said electron acceptor in electrical communication with said acceptor member.

9. The organic circuit element of claim 2 wherein said donor member, said acceptor member and said regulator member intersect to define said electric field regulation junction.

10. The organic circuit element of claim 2 wherein said regulator member intersects with one of said donor member and said acceptor member to define said electric field regulation junction.

11. The organic circuit element of claim 2 wherein said plurality of members comprises a common member, and wherein said donor member, said acceptor member and said regulator member intersect said common member at first, second and third locations respectively, said third location defining said electric field regulation junction.

12. The organic circuit element of claim 2 wherein said at least one regulator member comprises a plurality of regulator members, said

plurality of regulator members intersecting other respective members of said plurality of members to define said at least one electric field regulation junction.

13. The organic circuit element of claim **2** wherein said conductive metal-containing oligonucleotide duplex comprises a first nucleic acid strand and a second nucleic acid strand, said first and said second nucleic acid strands comprising respective pluralities of nitrogen-containing aromatic bases covalently linked by a backbone, said nitrogen-containing aromatic bases of said first nucleic acid strand being joined by hydrogen bonding to said nitrogen-containing aromatic bases of said second nucleic acid strand, said nitrogen-containing aromatic bases on said first and said second nucleic acid strands forming hydrogen-bonded base pairs in stacked arrangement along a length of said conductive metal-containing oligonucleotide duplex, said hydrogen-bonded base pairs comprising an interchelated metal cation coordinated to a nitrogen atom in one of said nitrogen-containing aromatic bases.

14. The organic circuit element of claim **13** wherein said interchelated metal cation comprises an interchelated divalent metal cation.

15. The organic circuit element of claim **14** wherein said divalent metal cation is selected from the group consisting of zinc, cobalt and nickel.

16. The organic circuit element of claim **13** wherein said metal cation is selected from the group consisting of the cations of Li, Be, Na, Mg, Al, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, As, Rb, Sr, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd, In, Sn, Sb, Cs, Ba, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Tl, Pb, Bi, Po, Fr, Ra, Ac, Th, Pa, U, Np and Pu.

17. The organic circuit element of claim **14** wherein said first and said second nucleic acid strands comprise deoxyribonucleic acid and said nitrogen-containing aromatic bases are selected from the group consisting of adenine, thymine, guanine and cytosine.

18. The organic circuit element of claim **14** wherein said divalent metal cations are substituted for imine protons of said nitrogen-containing aromatic bases, and said nitrogen-containing aromatic bases are selected from the group consisting of thymine and guanine.

19. The organic circuit element of claim **14** wherein at least one of said nitrogen-containing aromatic bases comprises thymine, having an N3 nitrogen atom, and said divalent metal cation is coordinated by said N3 nitrogen atom.

20. The organic circuit element of claim **14** wherein at least one of said nitrogen-containing aromatic bases comprises guanine, having an N1 nitrogen atom, and said divalent metal cation is coordinated by said N1 nitrogen atom.

21. The organic circuit element of claim **8** wherein said electron donor comprises an electrode operable to donate an electron to said donor member.

22. The organic circuit element of claim **8** wherein said electron acceptor comprises an electrode operable to accept an electron from said acceptor member.

23. The organic circuit element of claim **8** wherein said electron donor comprises an electron donor molecule capable of donating an electron to said donor member.

24. The organic circuit element of claim **23** wherein said electron donor molecule comprises a fluorescent molecule.

25. The organic circuit element of claim **24** wherein said electron donor molecule comprises fluorescein.

26. The organic circuit element of claim **8** wherein said electron acceptor comprises an electron acceptor molecule capable of accepting an electron from said acceptor member.

27. The organic circuit element of claim **26** wherein said electron acceptor molecule comprises a fluorescent molecule.

28. The organic circuit element of claim **27** wherein said electron acceptor molecule comprises rhodamine.

29. The organic circuit element of claim **8** wherein said electric field regulator comprises a regulator chromophore.

30. The organic circuit element of claim **8** wherein said electric field regulator comprises a fluorescent molecule

31. The organic circuit element of claim **8** wherein said electric field regulator comprises a fluorescein.

32. The organic circuit element of claim **8** wherein said electric field regulator comprises a rhodamine.

33. The organic circuit element of claim **29** wherein said regulator chromophore absorbs radiation within a range of wavelengths.

34. The organic circuit element of claim **8** wherein said electron acceptor comprises a chromophore operable to emit radiation within a range of wavelengths in response to accepting an electron from said acceptor member.

35. The organic circuit element of claim **8** wherein said electric field regulator comprises an electrode.

36. The organic circuit element of claim **8** wherein said electric field regulator comprises a plurality of states, each state of said plurality of states being selectable to produce a respective electrostatic potential at said electric field regulation junction.

37. The organic circuit element of claim **36** wherein said states are selectable in response to an applied external potential.

38. A system comprising the organic circuit element of claim **8** and further comprising a conductive medium for supplying conduction electrons to said electron donor and for receiving conduction electrons from said electron acceptor.

39. The system of claim **38** wherein said conductive medium is operable to donate electrons to said electron donor, and is operable to accept electrons from said electron acceptor to provide a closed circuitway for electrons to flow from said electron donor, through said donor member, through said electric field regulation junction, through said acceptor member, through said electron acceptor, and back to said electron donor.

40. The system of claim **39** wherein said conductive medium comprises an aqueous solution.

41. The system of claim **39** wherein said conductive medium comprises a conductive wire.

42. A method of making an organic circuit element, the method comprising annealing and treating a plurality of oligonucleotides to form a plurality of members, each member of said plurality of members comprising a pair of said oligonucleotides aligned to form a duplex portion, said plurality of members comprising:

a) at least one donor member for receiving conduction electrons from an electron donor;

b) at least one acceptor member for communicating with an electron acceptor to provide a region of attraction for said conduction electrons; and

c) at least one regulator member intersecting with at least one of said plurality of members to define at least one electric field regulation junction, for cooperating with an electric field regulator to regulate an electric field at the junction.

43. The method of claim **42** further comprising placing said electron donor in electrical communication with said donor member.

44. The method of claim **42** further comprising placing said electron acceptor in electrical communication with said acceptor member.

45. The method of claim **42** further comprising placing said electric field regulator in electrical communication with said regulator member.

46. The method of claim **45** further comprising placing said electron donor and said electron acceptor in electrical communication with said donor member and said acceptor member, respectively.

47. The method of claim **42** wherein annealing and treating comprise annealing and treating said plurality of oligonucleotides to form said plurality of members in a configuration in which said donor member, said acceptor member and said regulator member intersect to define said electric field regulation junction.

48. The method of claim **42** wherein annealing and treating comprise annealing and treating said plurality of oligonucleotides to form said plurality of members in a configuration in which said regulator member intersects with one of said donor member and said acceptor member to define said electric field regulation junction.

49. The method of claim **42** wherein said plurality of members comprises a common member, and wherein annealing and treating comprise annealing and treating said plurality of oligonucleotides to form said plurality of members in a configuration in which said donor member, said acceptor member and said regulator member intersect said common member at first, second and third locations respectively, said third location defining said electric field regulation junction.

50. The method of claim **42** wherein said plurality of members comprises a plurality of regulator members, and wherein annealing and treating comprise annealing and treating said plurality of oligonucleotides to form said plurality of members in a configuration in which said plurality of regulator members intersect said plurality of members to define the at least one electric field regulation junction.

51. The method of claim **42** wherein annealing comprises annealing said plurality of oligonucleotides in conditions effective to form said duplex portion, and treating comprises treating said plurality of oligonucleotides in conditions effective to form said at least one electric field regulation junction.

52. The method of claim **42** wherein said oligonucleotides comprise a plurality of nitrogen-containing aromatic bases covalently linked by a backbone.

53. The method of claim **52** wherein said oligonucleotides comprise a deoxyribonucleic acid comprising nitrogen-containing aromatic bases selected from the group consisting of adenine, thymine, guanine, cytosine, and uracil.

54. The method of claim **52** wherein said duplex portion comprises a conductive metal-containing oligonucleotide duplex portion, said conductive metal-containing oligonucleotide duplex portion comprising

a first strand and a second strand of said oligonucleotides, said nitrogen-containing aromatic bases of said first strand joined by hydrogen bonding to said nitrogen-containing aromatic bases of said second strand, said nitrogen-containing aromatic bases on said first and second strands forming hydrogen-bonded base pairs in stacked arrangement along a length of said conductive metal-containing oligonucleotide duplex portion, said hydrogen-bonded base pairs comprising an interchelated metal cation coordinated to a nitrogen atom in one of said nitrogen-containing aromatic bases.

55. The method of claim **54** wherein said interchelated metal cation comprises an interchelated divalent metal cation.

56. The method of claim **55** wherein annealing comprises subjecting said plurality of oligonucleotides to a basic solution under conditions effective to form said conductive metal-containing oligonucleotide duplex portion.

57. The method of claim **56** wherein said conditions effective to form said conductive metal-containing oligonucleotide duplex portion are effective to substitute said divalent metal cations for an imine proton of a nitrogen containing aromatic base in said conductive metal-containing oligonucleotide duplex portion.

58. The method of claim **56** wherein said basic solution has a pH of at least **7.**

59. The method of claim **56** wherein said basic solution has a nucleic acid to metal ion ratio of about **1:1.5** to about **1:2.0.**

60. The method of claim **55** wherein said divalent metal cation is selected from the group consisting of zinc, cobalt and nickel.

61. The method of claim **54** wherein said metal cation is selected from the group consisting of the cations of Li, Be, Na, Mg, Al, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, As, Rb, Sr, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd, In, Sn, Sb, Cs, Ba, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Tl, Pb, Bi, Po, Fr, Ra, Ac, Th, Pa, U, Np and Pu.

62. The method of claim **55** wherein said divalent metal cations are substituted for imine protons of the nitrogen-containing aromatic bases, and the nitrogen-containing aromatic bases are selected from the group consisting of thymine and guanine.

63. The method of claim **55** wherein at least one of the nitrogen-containing aromatic bases comprises thymine, having an N**3** nitrogen atom, and the divalent metal cation is coordinated by the N**3** nitrogen atom.

64. The method of claim **55** wherein at least one of the nitrogen-containing aromatic bases comprises guanine, having an N**1** nitrogen atom, and the divalent metal cation is coordinated by the N**1** nitrogen atom.

65. The method of claim **46** wherein said electron donor comprises an electron donor molecule capable of donating an electron to said donor member.

66. The method of claim **46** wherein said electron acceptor comprises an electron acceptor molecule capable of accepting an electron from said acceptor member.

67. The method of claim **65** wherein said electron donor molecule comprises a fluorescent molecule.

68. The method of claim **66** wherein said electron acceptor molecule comprises a fluorescent molecule.

69. The method of claim **67** wherein said electron donor molecule comprises fluorescein.

70. The method of claim **68** wherein said electron acceptor molecule comprises rhodamine.

71. The method of claim **46** wherein said electron donor comprises an electrode operable to donate an electron to said donor member.

72. The method of claim **46** wherein said electron acceptor comprises an electrode operable to accept an electron from said acceptor member.

73. The method of claim **46** wherein said electric field regulator comprises a regulator chromophore.

74. The method of claim **46** wherein said electric field regulator comprises a fluorescent molecule.

75. The method of claim **46** wherein said electric field regulator comprises a fluorescein.

76. The method of claim **46** wherein said electric field regulator comprises a rhodamine.

77. The method of claim **73** wherein said regulator chromophore absorbs radiation within a range of wavelengths.

78. The method of claim **46** wherein said electron acceptor comprises a chromophore operable to emit radiation within a range of wavelengths in response to accepting an electron from said acceptor member.

79. The method of claim **42** wherein treating comprises subjecting said plurality of oligonucleotides to a basic solution under conditions effective to form said electric field regulation junction.

80. The method of claim **46** wherein said electric field regulator comprises an electrode.

81. The method of claim **46** wherein said electric field regulator comprises a plurality of states, each state of said plurality of states being selectable to produce a respective electrostatic potential at said electric field regulation junction.

82. A method of regulating an electronic signal between first and second locations in a conductive nucleic acid material, the method comprising varying an electrostatic potential at a third location in the nucleic acid material interposed between the first and second locations.

83. The method of claim **82** wherein varying comprises selecting one of a plurality of states of an electric field regulator in communication with the third location, each of the states corresponding to a respective electrostatic potential at the third location.

84. The method of claim **83** wherein selecting comprises irradiating the electric field regulator.

85. The method of claim **83** wherein the electric field regulator is selected from the group consisting of fluorescent molecules and chromophores, and wherein selecting comprises irradiating the electric field regulator.

86. The method of claim **83** wherein the electric field regulator comprises a chromophore, and wherein selecting comprises irradiating the electric field regulator.

87. The method of claim **86** wherein irradiating comprises irradiating the chromophore to cause a negative electrostatic potential to be applied to the third location.

88. The method of claim **83** wherein selecting comprises applying an external potential to the electric field regulator.

89. The method of claim **83** wherein said electric field regulator comprises an electrode, and wherein selecting comprises applying an external potential to the electrode.

90. The method of claim **89** wherein applying comprises depositing at least one electron onto said electrode to apply a negative electrostatic potential to the third location.

91. The method of claim **89** wherein applying comprises removing at least one electron from said electrode to apply a positive electrostatic potential to the third location.

92. The method of claim **83** further comprising producing the electronic signal.

93. The method of claim **92** wherein producing comprises causing electrons to flow from the first location to the second location.

94. The method of claim **93** further comprising supplying electrons to the first location and receiving electrons from the second location.

95. The method of claim **82** wherein the first location comprises a location in a conductive nucleic acid electron donor member, the second location comprises a location in a conductive nucleic acid electron acceptor member, and the third location comprises at least one electric field regulation junction in electrical communication with the donor member and the acceptor member, and wherein varying comprises varying the electrostatic potential at the at least one electric field regulation junction.

96. The method of claim **95** wherein the at least one electric field regulation junction is in electrical communication with a conductive nucleic acid electric field regulator member, and wherein varying comprises selecting one of a plurality of states of an electric field regulator in electrical communication with the regulator member, each of the states corresponding to a respective electrostatic potential at the at least one electric field regulation junction.

97. The method of claim **96** wherein selecting comprises irradiating the electric field regulator.

98. The method of claim **96** wherein the electric field regulator is selected from the group consisting of fluorescent molecules and chromophores, and wherein selecting comprises irradiating the electric field regulator.

99. The method of claim **96** wherein the electric field regulator comprises a chromophore, and wherein selecting comprises irradiating the electric field regulator.

100. The method of claim **99** wherein irradiating comprises irradiating the chromophore to cause a negative electrostatic potential to be applied to said electric field regulation junction, said negative electrostatic potential decreasing the ability of an electron to travel from said donor member to said acceptor member.

101. The method of claim **96** wherein selecting comprises applying an external potential to the electric field regulator.

102. The method of claim **96** wherein said electric field regulator comprises an electrode, and wherein selecting comprises applying an external potential to the electrode.

103. The method of claim **102** wherein applying comprises depositing at least one electron onto said electrode to apply a negative electrostatic

potential to said electric field regulation junction, said negative electrostatic potential decreasing the ability of an electron to travel from said donor member to said acceptor member.

104. The method of claim **102** wherein applying comprises removing at least one electron from said electrode to apply a positive electrostatic potential to said electric field regulation junction, said positive electrostatic potential increasing the ability of an electron to travel from said donor member to said acceptor member.

105. The method of claim **96** further comprising placing the electron donor member, the electron acceptor member, and the regulator member in electrical communication with an electron donor, an electron acceptor, and the electric field regulator, respectively.

106. The method of claim **95** further comprising producing the electronic signal.

107. The method of claim **106** wherein producing comprises causing electrons to flow from an electron donor in communication with the electron donor member, to an electron acceptor in communication with the electron acceptor member.

108. The method of claim **107** further comprising supplying electrons to the electron donor and receiving electrons from the electron acceptor.

109. The method of claim **95** wherein the at least one electric field regulation junction comprises at least two electric field regulation junctions in electrical communication with at least two respective electric field regulators, and wherein varying comprises selecting one of a plurality of states of at least one of the at least two electric field regulators, each of the states corresponding to a respective electrostatic potential at the

electric field regulation junction corresponding to the at least one of the at least two electric field regulators.

110. The method of claim **82** wherein the conductive nucleic acid material comprises a plurality of members, each of which comprises a conductive metal-containing oligonucleotide duplex, said plurality of members comprising at least one donor member for receiving conduction electrons from an electron donor, at least one acceptor member for communicating with an electron acceptor to provide a region of attraction for said conduction electrons, and at least one regulator member intersecting with at least one of said plurality of members to define at least one electric field regulation junction, for cooperating with an electric field regulator to regulate an electric field at the junction; and wherein varying comprises selecting one of a plurality of states of the electric field regulator, each of the states corresponding to a respective electrostatic potential at the electric field regulation junction.

111. The method of claim **82** wherein the conductive nucleic acid material comprises a conductive metal-containing nucleic acid duplex, said conductive metal-containing nucleic acid duplex comprising a regulator member in electrical communication with an electric field regulator, a donor member in electrical communication with an electron donor, and an acceptor member in electrical communication with an electron acceptor, and wherein varying comprises changing a state of said electric field regulator to vary an electrostatic potential at an electric field regulation junction joining said regulator member, said donor member, and said acceptor member, to regulate the signal.

112. The method of claim **111** wherein said conductive metal-containing nucleic acid duplex comprises a nucleic acid duplex comprising a first nucleic acid strand and a second nucleic acid strand, said first and said

second nucleic acid strands comprising respective pluralities of nitrogen-containing aromatic bases covalently linked by a backbone, said nitrogen-containing aromatic bases of said first nucleic acid strand being joined by hydrogen bonding to said nitrogen-containing aromatic bases of said second nucleic acid strand, said nitrogen-containing aromatic bases on said first and said second nucleic acid strands forming hydrogen-bonded base pairs in stacked arrangement along a length of said nucleic acid duplex.

113. The method of claim **112** further comprising producing said conductive metal-containing nucleic acid duplex.

114. The method of claim **113** wherein producing comprises subjecting said nucleic acid duplex to a basic solution in the presence of a metal cation under conditions effective to form said conductive metal-containing nucleic acid duplex, wherein said hydrogen-bonded base pairs of said conductive metal-containing nucleic acid duplex comprise an interchelated metal cation coordinated to a nitrogen atom in one of said nitrogen-containing aromatic bases.

115. The method of claim **113** wherein producing comprises subjecting said nucleic acid duplex to a basic solution in the presence of a divalent metal cation under conditions effective to form said conductive metal-containing nucleic acid duplex, wherein said hydrogen-bonded base pairs of said conductive metal-containing nucleic acid duplex comprise an interchelated divalent metal cation coordinated to a nitrogen atom in one of said nitrogen-containing aromatic bases.

116. The method of claim **115** wherein said nucleic acid duplex comprises a deoxyribonucleic acid duplex comprising nitrogen-containing aromatic bases selected from the group consisting of adenine, thymine, guanine and cytosine.

117. The method of claim **115** wherein said conditions effective to form said conductive metal-containing nucleic acid duplex are effective to substitute said divalent metal cations for an imine proton of a nitrogen containing aromatic base in said nucleic acid duplex.

118. The method of claim **115** wherein said divalent metal cation is selected from the group consisting of zinc, cobalt and nickel.

119. The method of claim **114** wherein said metal cation is selected from the group consisting of the cations of Li, Be, Na, Mg, Al, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, As, Rb, Sr, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd, In, Sn, Sb, Cs, Ba, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Tl, Pb, Bi, Po, Fr, Ra, Ac, Th, Pa, U, Np and Pu.

120. The method of claim **114** wherein said basic solution has a pH of at least **7**.

121. The method of claim **114** wherein said basic solution has a nucleic acid to metal ion ratio of about **1:1.5** to about **1:2.0**.

122. The method of claim **111** wherein said electron donor comprises an electron donor molecule capable of donating an electron to said donor member.

123. The method of claim **111** wherein said electron acceptor comprises an electron acceptor molecule capable of accepting an electron from said acceptor member.

124. The method of claim **122** wherein said electron donor molecule comprises a fluorescent molecule.

125. The method of claim **123** wherein said electron acceptor molecule comprises a fluorescent molecule.

126. The method of claim **124** wherein said electron donor molecule comprises fluorescein.

127. The method of claim **125** wherein said electron acceptor molecule comprises rhodamine.

128. The method of claim **111** wherein said electron donor comprises an electrode operable to donate an electron to said donor member.

129. The method of claim **111** wherein said electron acceptor comprises an electrode operable to accept an electron from said acceptor member.

130. The method of claim **111** wherein said electric field regulator comprises a regulator chromophore.

131. The method of claim **111** wherein said electric field regulator comprises a fluorescent molecule.

132. The method of claim **111** wherein said electric field regulator comprises a fluorescein.

133. The method of claim **111** wherein said electric field regulator comprises a rhodamine.

134. The method of claim **130** wherein said regulator chromophore absorbs radiation within a range of wavelengths.

135. The method of claim **111** wherein said electron acceptor comprises a chromophore operable to emit radiation within a range of wavelengths in response to accepting an electron from said acceptor member.

136. The method of claim **112** wherein said regulator member comprises a conductive metal-containing nucleic acid duplex portion.

137. The method of claim **112** wherein said donor member comprises a conductive metal-containing nucleic acid duplex portion.

138. The method of claim **112** wherein said acceptor member comprises a conductive metal-containing nucleic acid duplex portion.

139. The method of claim **111** further comprising supplying conduction electrons from a conductive medium to the conductive metal-containing nucleic acid duplex, and receiving conduction electrons from the duplex at the conductive medium.

140. The method of claim **139** wherein supplying comprises donating electrons from the conductive medium to said electron donor and wherein receiving comprises accepting electrons from said electron acceptor at the conductive medium, to provide a closed circuitway for electrons to flow from said electron donor, through said donor member, through said electric field regulation junction, through said acceptor member, through said electron acceptor, and through the conductive medium to said electron donor.

141. The method of claim **140** wherein said conductive medium comprises an aqueous solution.

142. The method of claim **140** wherein said conductive medium comprises a conductive wire.

143. The method of claim **134** wherein changing the state of said electric field regulator comprises irradiating said regulator chromophore to cause a negative electrostatic potential to be produced and applied to said electric field regulation junction, said negative electrostatic potential decreasing the ability of an electron to travel from said donor member to said acceptor member.

144. The method of claim **111** wherein said electric field regulator comprises an electrode.

145. The method of claim **111** wherein said electric field regulator comprises an electrode, and wherein changing the state of said electric field regulator comprises depositing an electron onto said electrode to produce a negative electrostatic potential applied to said electric field regulation junction, said negative electrostatic potential decreasing the ability of an electron to travel from said donor member to said acceptor member.

146. The method of claim **111** wherein said electric field regulator comprises an electrode, and wherein changing the state of said electric field regulator comprises removing an electron from said electrode to produce a positive electrostatic potential applied to said electric field regulation junction, said positive electrostatic potential increasing the ability of an electron to travel from said donor member to said acceptor member.

147. The method of claim **111** wherein said electric field regulator comprises a plurality of states, each state of said plurality of states being selectable in response to an applied external potential to produce a respective electrostatic potential at said electric field regulation junction.

148. An apparatus for regulating an electronic signal between first and second locations in a conductive nucleic acid material, the apparatus comprising:

a) the conductive nucleic acid material having the first and second locations; and

b) means for varying an electrostatic potential at a third location in the nucleic acid material interposed between the first and second locations.

149. The apparatus of claim **148** wherein said means for varying comprises means for selecting one of a plurality of states of an electric field regulator in communication with the third location, each of the states corresponding to a respective electrostatic potential at the third location.

150. The apparatus of claim **149** wherein said means for selecting comprises means for irradiating the electric field regulator.

151. The apparatus of claim **149** wherein said means for selecting comprises means for applying an external potential to the electric field regulator.

152. The apparatus of claim **151** wherein said electric field regulator comprises an electrode, and wherein said means for applying comprises means for depositing at least one electron onto said electrode to apply a negative electrostatic potential to the third location.

153. The apparatus of claim **151** wherein said electric field regulator comprises an electrode, and wherein said means for applying comprises means for removing at least one electron from said electrode to apply a positive electrostatic potential to the third location.

154. The apparatus of claim **148** further comprising means for producing the electronic signal.

155. The apparatus of claim **148** wherein the first location comprises a location in a conductive nucleic acid electron donor member, the second location comprises a location in a conductive nucleic acid electron acceptor member, and the third location comprises at least

one electric field regulation junction in electrical communication with the donor member and the acceptor member, and wherein said means for varying comprises means for varying the electrostatic potential at the at least one electric field regulation junction.

156. The apparatus of claim **155** wherein the at least one electric field regulation junction is in electrical communication with a conductive nucleic acid electric field regulator member, and wherein said means for varying comprises means for selecting one of a plurality of states of an electric field regulator in electrical communication with the regulator member, each of the states corresponding to a respective electrostatic potential at the at least one electric field regulation junction.

157. The apparatus of claim **156** wherein said means for selecting comprises means for irradiating the electric field regulator.

158. The apparatus of claim **156** wherein said means for selecting comprises means for applying an external potential to the electric field regulator.

159. The apparatus of claim **158** wherein said electric field regulator comprises an electrode, and wherein said means for applying comprises means for depositing at least one electron onto said electrode to apply a negative electrostatic potential to said electric field regulation junction, said negative electrostatic potential decreasing the ability of an electron to travel from said donor member to said acceptor member.

160. The apparatus of claim **158** wherein said electric field regulator comprises an electrode, and wherein said means for applying comprises means for removing at least one electron from said electrode to apply a positive electrostatic potential to said electric field regulation junction, said positive electrostatic potential increasing the

ability of an electron to travel from said donor member to said acceptor member.

161. The apparatus of claim **155** further comprising means for producing the electronic signal.

162. An apparatus for regulating an electronic signal between first and second locations in a conductive nucleic acid material, the apparatus comprising an electric field regulator operable to vary an electrostatic potential at a third location in the nucleic acid material interposed between the first and second locations.

163. The apparatus of claim **162** wherein said electric field regulator has a plurality of selectable states, each of the states corresponding to a respective electrostatic potential at the third location.

164. The apparatus of claim **162** wherein said electric field regulator comprises an electrode.

165. The apparatus of claim **162** wherein said electric field regulator is selected from the group consisting of fluorescent molecules and chromophores.

166. The apparatus of claim **162** wherein said electric field regulator comprises a chromophore.

167. The apparatus of claim **162** wherein said electric field regulator comprises a fluorescent molecule.

168. The apparatus of claim **162** wherein said electric field regulator comprises a fluorescein.

169. The apparatus of claim **162** wherein said electric field regulator comprises a rhodamine.

170. The apparatus of claim **162** wherein the first location comprises a location in a conductive nucleic acid electron donor member, the second location comprises a location in a conductive nucleic acid electron acceptor member, and the third location comprises at least one electric field regulation junction in electrical communication with the donor member, the acceptor member, and said electric field regulator.

171. The apparatus of claim **170** further comprising a regulator member joining said electric field regulator to said electric field regulation junction.

172. A method of regulating an electronic signal in a conductive nucleic acid material, the method comprising varying a degree of electric field regulation at an electric field regulation junction at which a regulator member intersects at least one of a plurality of members, each of said regulator member and said plurality of members comprising an oligonucleotide duplex and at least some of said regulator member and said plurality of members comprising a conductive metal-containing oligonucleotide duplex, said plurality of members comprising at least one donor member for receiving conduction electrons from an electron donor, and at least one acceptor member for communicating with an electron acceptor to provide a region of attraction for said conduction electrons.

173. The method of claim **172** wherein varying comprises varying an electrostatic potential at said electric field regulation junction.

174. The method of claim **172** wherein varying comprises selecting one of a plurality of states of an electric field regulator in communication with the electric field regulation junction via the regulator member.

175. The method of claim 174 wherein selecting comprises irradiating the electric field regulator.

176. The method of claim 174 wherein selecting comprises applying an external potential to the electric field regulator.

177. A method of storing data, the method comprising selecting one of at least two states of an electric field regulator of a nucleic acid circuit element, each of said at least two states corresponding to a respective degree of electric field regulation at an electric field regulation junction in the circuit element, each said degree of electric field regulation corresponding to a respective data value.

178. The method of claim 177 wherein selecting comprises irradiating the electric field regulator.

179. The method of claim 177 wherein selecting comprises applying an external potential to the electric field regulator.

180. The method of claim 177 wherein said nucleic acid circuit element comprises a plurality of members, at least some of which comprise a conductive metal-containing oligonucleotide duplex, said plurality of members comprising at least one donor member for receiving conduction electrons from an electron donor, at least one acceptor member for communicating with an electron acceptor to provide a region of attraction for said conduction electrons, and at least one regulator member intersecting with at least one of said plurality of members to define said electric field regulation junction, said regulator member being in communication with said electric field regulator, and wherein selecting comprises causing said electric field regulation junction to apply said degree of electric field regulation to the electric field regulation junction, to represent said data value.

181. The method of claim **180** wherein causing comprises selecting one of a plurality of states of said electric field regulator, each of said states corresponding to a respective electrostatic potential at said electric field regulation junction.

182. An organic data storage medium comprising an electric field regulator having at least two selectable states, each of the states corresponding to a respective degree of electric field regulation at an electric field regulation junction of a nucleic acid circuit element, each said degree of electric field regulation corresponding to a respective data value.

183. The organic data storage medium of claim **182** further comprising said nucleic acid circuit element, said nucleic acid circuit element comprising a plurality of members, at least some of which comprise a conductive metal-containing oligonucleotide duplex, said plurality of members comprising:

a) at least one donor member for receiving conduction electrons from an electron donor;

b) at least one acceptor member for communicating with an electron acceptor to provide a region of attraction for said conduction electrons; and

c) at least one regulator member intersecting with at least one of said plurality of members to define said electric field regulation junction, for cooperating with said electric field regulator to apply said degree of electric field regulation to said junction, to represent said data value.

184. The organic data storage medium of claim **182** wherein said at least two states are selectable by irradiating said electric field regulator.

185. The organic data storage medium of claim **182** wherein said at least two states are selectable by applying an external potential to said electric field regulator.

186. The organic data storage medium of claim **183** wherein each of said at least two states corresponds to a respective electrostatic potential at said electric field regulation junction.

187. An apparatus for storing data, the apparatus comprising:

a) a conductive nucleic acid circuit element comprising an electric field regulation junction; and

b) means for varying a degree of electric field regulation at said electric field regulation junction in said circuit element, each said degree of electric field regulation corresponding to a respective data value.

188. The apparatus of claim **187** wherein said means for varying comprises means for varying an electrostatic potential at the electric field regulation junction.

189. An electrical conductor comprising an electron source electrically coupled to a conductive metal-containing nucleic acid duplex, the conductive metal-containing nucleic acid duplex comprising a first strand of nucleic acid and a second strand of nucleic acid, the first and the second nucleic acid strands comprising a plurality of nitrogen-containing aromatic bases covalently linked by a backbone, the nitrogen-containing aromatic bases of the first nucleic acid strand being joined by hydrogen bonding to the nitrogen-containing aromatic bases of the second nucleic acid strand, the nitrogen-containing aromatic bases on the first and the second nucleic acid strands forming hydrogen-bonded base pairs in stacked arrangement along the length

of the conductive metal-containing nucleic acid duplex, the hydrogen-bonded base pairs comprising an interchelated divalent metal cation coordinated to a nitrogen atom in one of the aromatic nitrogen-containing aromatic bases, to form the electrical conductor, further comprising an electron sink electrically coupled to the conductive metal-containing nucleic acid duplex, wherein the electron source is a molecule capable of donating an electron to the conductive metal-containing nucleic acid duplex, and the electron sink is an electron acceptor molecule capable of accepting an electron from the conductive metal-containing nucleic acid duplex, and wherein the electron donor or the electron acceptor are adapted to be reversibly chemically modified to alter the conductivity of the organic circuit element under conditions that preserve the conductivity of the circuit element.